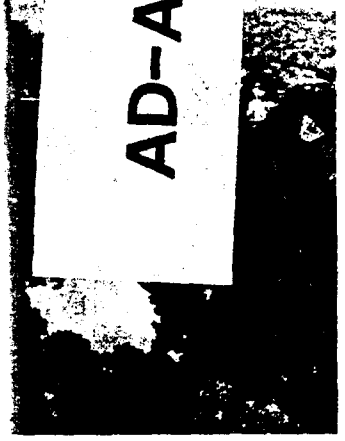

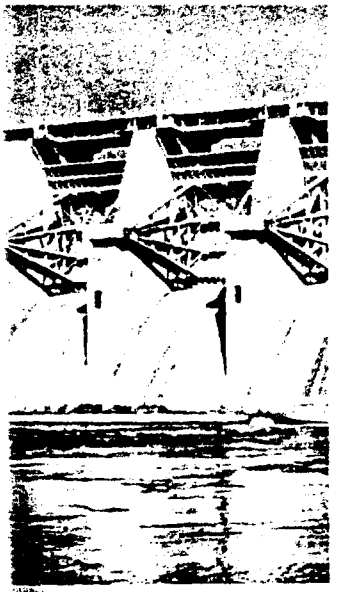

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MITIGATION DATABASE: TRACKING MITIGATION ACTIVITIES IN THE SECTION 404 PERMITTING PROGRAM

by

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Final Report

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This report presents a recommended list of variables for development of a mitigation database by US Army Corps of Engineers (CE) Regulatory offices. Uses of the database include periodic review of CE Regulatory program mitigation efforts, evaluation of trends in permitted wetland activities, and preparation of responses to public or agency inquiries. Depending upon the level of implementation chosen, the mitigation database contains information on wetland types and acreages impacted, restored, or created; the spatial distribution of projects; effects of the permit review process in lessening potential impacts; wetland functions and values considered in permit decisions; mitigation goals; and restoration or compensation methods.

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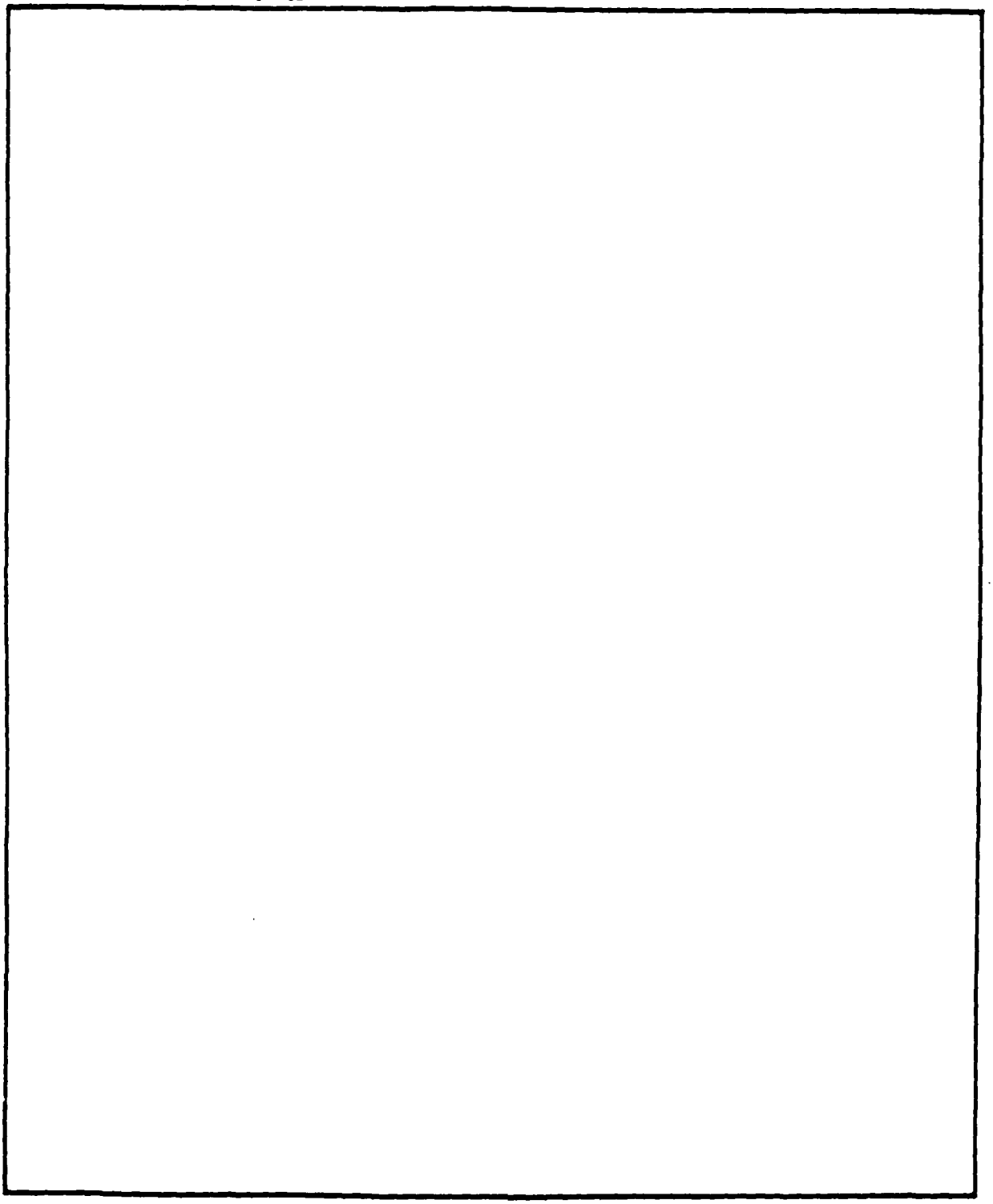

PREFACE

This report was sponsored by the Regulatory Branch, Operations Division, of the US Army Engineer Division, New England (NED), as part of a cooperative study of the effectiveness of mitigation in the Section 404 individual permitting program in New England. It was prepared by Dr. James S. Wakeley of the Wetlands and Terrestrial Habitat Group (WTHG), US Army Engineer Waterways Experiment Station (WES). During this period, Mr. Ellis J. Clairain, Jr., was Team Leader, Wetlands Research Team; Dr. Hanley K. Smith was Chief, WTHG; Dr. Conrad J. Kirby was Chief, Environmental Resources Division (ERD); and Dr. John Harrison was Chief, Environmental Laboratory. Mr. William F. Lawless was Chief, Regulatory Branch, NED.

Technical reviews were provided by Messrs. Michael J. Sheehan, Douglas Sparrow, and Frank Smegelski of the NED, and by Messrs. Clairain, Charles J. Newling, and Robert L. Lazor of the WTHG. The report was edited by Ms. Jessica S. Ruff of the WES Information Technology Laboratory.

Commander and Director of WES was COL Larry B. Fulton, EN. Dr. Robert W. Whalin was Technical Director.

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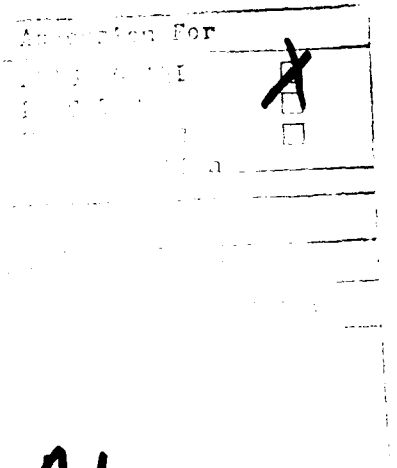

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CONTENTS

MITIGATION DATABASE: TRACKING MITIGATION ACTIVITIES IN THE SECTION 404 PERMITTING PROGRAM

PART I: INTRODUCTION

1. Under Section 404 of the Clean Water Act, the US Army Corps of Engineers (CE) is given authority to regulate and issue permits for activities involving the discharge of dredged or fill material into wetlands and other "waters of the United States." Nationwide, the CE issues more than 5,000 Section 404 individual permits per year (Barton 1986). The number of individual permits has declined since the late 1970s, apparently because an increasing number of projects are now covered under general permits. Unfortunately, there is very little information on the types and acreages of wetlands impacted, or on the effects of mitigation during the permit review process in reducing potential impacts (Barton 1986).

2. The fact that wetland systems provide important human benefits has long been known by wildlife managers and waterfowl hunters, who value these habitats as breeding, resting, and wintering areas for a variety of popular game species. It is only during the last decade, however, that the general public has become aware of the valuable services wetlands provide, including stabilization of sediments and shorelines, improvement of water quality, recharge of ground water, retention and dampening of flood flows, and refuge for endangered plants and animals. Because of the importance of wetlands, the CE is seeking more effective ways to document its Regulatory program activities, determine the effects of permitted projects on wetland resources, and evaluate the success of mitigation efforts.

3. This report presents a recommended list of variables for development of a mitigation database by CE Regulatory offices. The proposed database would allow the periodic review and evaluation of mitigation efforts under the CE Regulatory program. It would provide current information needed to make decisions, as well as historical data to determine trends and make projections; also, it would provide the documentation of CE mitigation activities needed to respond to public inquiries.

4. The choice of variables to include in the database is flexible, depending upon the needs of each CE Regulatory office. Based on the level of implementation, the mitigation database could aid in the following analyses:

- Periodically summarize gains and losses in wetland acreage.
- Determine the spatial arrangement of wetland projects on the landscape.
- Determine which wetland types are most often affected.
- Examine temporal trends in the distribution and magnitude of wetland impacts.
- Evaluate changes in the magnitude of wetland impacts as a result of permit review.
- Determine which wetland functions and values are most important in evaluating projects and setting the conditions of permits.
- Evaluate trade-offs among the acreages and types of wetlands destroyed, damaged, restored, and created by permitted projects.
- Determine what methods are typically prescribed for restoration of damaged wetlands or creation of man-made wetlands.
- Document mitigation goals for each project.
- Document the kinds of monitoring required in permits.

Specific questions related to each of these general tasks are given in Part III.

PART II: EVALUATION OF EXISTING PERMIT DATABASES

Current CE Permit Databases

5. The NED and most Districts currently use permit databases to keep track of important administrative deadlines and to generate periodic reports on permitting activity for the Headquarters, US Army Corps of Engineers (HQUSACE). The system used by NED will be used as an example. As of April 1987, that database contained nearly 10,000 records of permits issued since 1978, of which more than 4,000 were Section 404 permits.*

6. The database primarily serves the administrative needs of NED and HQUSACE. The variables identify the applicant, CE project manager, type and location of the work, and legal authority under which the permit was required. Many of the variables consist of dates when various steps in the review process were completed, such as when the initial application was received, the public notice issued, and final action taken.

7. NED's current database contains little information that could be used to evaluate mitigation practices on Section 404 permits. Variables relevant to mitigation include codes for the river basin where the project was located and for the type of wetland filled. However, the database allows only a single wetland code and, therefore, does not provide for projects that affect more than one wetland type. There is also a one-character code (Yes or No) indicating whether the applicant's plans were modified during review to reduce detrimental effects, and a similar code if compensation in the form of wetland construction was required. Another variable indicates whether a compliance inspection was recommended.

8. Recently, some variables were added to the database, increasing its usefulness in studies of mitigation. The new variables include the number of acres of wetland and deepwater fill requested by the applicant initially, and the number allowed in the final permit. They also include the acreage dredged, if any, and the Universal Transverse Mercator (UTM) coordinate location of the project.

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* Personal Communication, 1988, Michael J. Sheehan, US Army Engineer Division, New England, Waltham, MA.

9. With only minimal modification, the current NED database could be used to accomplish some of the tasks listed in paragraph 4. For example, if the acreage of fill were recorded separately for each wetland type impacted by a project, analyses of wetland losses by type, geographic location, and time period would be possible. However, there should also be an accounting of wetland gains resulting from restoration of damages or construction of new wetlands. Wetland acreage gained through restoration or compensation should be tallied separately to allow for independent analysis in addition to the calculation of net changes in wetland acreage.

10. Similarly, if the acreage of fill originally requested in the application and the amount allowed in the permit were recorded by wetland type, these variables would provide much more useful information on mitigation achieved during permit review. However, these variables tell only part of the story because they do not take into account mitigation that was accomplished before the application was submitted, as a result of preapplication counseling. The inclusion of information concerning preapplication discussions would require additional variables and, perhaps, additional record-keeping by Regulatory staff.

11. Beyond questions of wetland acreage, other concerns enter into the permit review process that should be documented in the database. These include wetland functions affected by the project, methods used in restoration or compensation, mitigation goals, and characteristics of postproject monitoring programs. Therefore, to accomplish the tasks listed previously, NED's current database should be enhanced by adding new variables and changing the way some existing information is recorded. The NED has initiated a complete restructuring of its data-management system, including information relevant to mitigation.

USEPA Wetlands Permit Database

12. In 1986, the US Environmental Protection Agency (USEPA) Environmental Research Laboratory in Corvallis, OR, initiated work on a database designed to compile and query information from the Section 404 permit record.*

* Personal Communication, 1988, M. Kentula, USEPA Environmental Research Laboratory, Corvallis, OR.

The system is designed to run on a microcomputer with dBase III software. A preliminary version has been distributed to USEPA regional offices for testing. The system is still evolving as USEPA personnel become more familiar with its operation and identify needed features.

13. The USEPA database has many features useful to CE Regulatory offices. Wetland types are identified to the class level, according to the Cowardin et al. (1979) classification system, and impacts are recorded separately for each wetland type. Important wetland functions and values are identified. Acreages of restored or created wetlands are recorded by wetland type. Mitigation objectives are specified, and methods used to restore or create wetlands are indicated. Finally, general information about any monitoring program is recorded.

14. The USEPA system, however, lacks information that is essential to evaluate mitigation success in the CE Regulatory program. For example, the USEPA database only includes acreages of wetland fill and of restored or created wetlands listed in the final permit. No information on the applicant's original request is recorded; therefore, mitigation achieved during the permit review process is not quantified. The USEPA database is designed only to quantify actual net losses (or gains) in wetland acreage resulting from Section 404 permitting and does not consider mitigation of potential impacts achieved through reductions in the magnitude of proposed projects. Mitigation through avoidance of unnecessary wetland damage is an extremely important benefit of the Section 404 permitting process.

15. An additional shortcoming of the USEPA database is that wetland restoration and creation are lumped rather than being considered separately. Separate consideration is preferable because mitigation goals, methods used, and the probability of success can be very different.

PART III: DATABASE QUERIES: QUESTIONS RELATED TO MITIGATION SUCCESS

16. A database is only as useful as the questions it is designed to answer. The proposed mitigation database would facilitate periodic review and rapid analysis of wetland impacts and mitigation activities resulting from the Section 404 permitting program. The remainder of this section consists of a list of questions that CE Regulatory offices may wish to answer using the database (see Appendix A for hypothetical database output). The list is intended to be reasonably comprehensive and is the basis for recommendations on database contents given in Part IV. The list has benefited from discussions with USEPA personnel and the NED Regulatory staff.

17. Here and in Part IV, a distinction is made among three alternative levels of database size and complexity: limited, moderate, and comprehensive. These levels represent different options for implementation of mitigation databases by Districts. Queries appropriate to each level are indicated below by L, M, and C, respectively. Table 1 summarizes the types of data included in each level.

18. A limited (L) database would allow only the most basic analyses of wetland acreage gained and lost, the spatial arrangement of projects, basic mitigation approaches, and quantification of mitigation achieved after the formal application for a permit was submitted (Table 1). A database of moderate (M) complexity would allow additional analyses of mitigation goals in relation to specific wetland functions and values, effects of preapplication counseling, methods used to restore or create wetlands, and results of compliance inspections. A comprehensive (C) database would contain additional information about mitigation of impacts to societal features, such as public facilities or aesthetic values, success at restoring particular wetland functions, details of planting methods used to restore or create vegetated wetlands, and general characteristics of postproject monitoring programs.

19. The proposed mitigation database can provide information on mitigation "success" in terms of wetland impacts that were avoided or minimized, wetland functions gained or lost, and acreages destroyed, restored, created, or enhanced. For projects involving wetland restoration or creation, however, an evaluation of mitigation success should include information on the

development of desired wetland characteristics in these altered environments. This in turn requires a monitoring program that might consist of periodic measurements of water quality parameters, sediment characteristics, macroinvertebrate densities, below-ground plant biomass, or breeding bird populations. A project might be deemed successful when these measurements compare favorably with those taken in undisturbed wetlands in the region or meet some other criteria. Although such detailed data may be needed to draw ultimate conclusions about mitigation success, they are beyond the scope of the proposed mitigation database.

20. The following potential database queries are arranged into categories by topics. Questions appropriate to a limited database would also be included in moderate and comprehensive versions, and are denoted LMC. Those appropriate to moderate and comprehensive applications, but not limited ones, are indicated by MC, and those intended only for comprehensive databases are indicated by C.

General Questions

21. Potential questions for this category are listed below.

LMC How many applications for Section 404 individual permits were submitted? (Data summaries should be provided by year, state, and hydrologic unit.)

LMC How many permits (and what proportion of applications) were granted?

LMC How many permits (and what proportion of applications) were granted unchanged in their environmental effects from the original application?

LMC How many permits (and what proportion of applications) were granted without terms or conditions designed to mitigate wetland impacts?

LMC What is the range of wetland acreages represented by permits that were granted without required mitigation?

LMC How many applications were withdrawn and/or denied?

LMC On how many permitted projects was construction never started?

LMC On how many permitted projects was required mitigation never completed?

LMC What proportion of projects involve impacts to one, two, three, or more separate wetland sites or units?

MC How many potential applicants participated in preapplication counseling with a Corps representative?

MC How many (and what proportion) of them subsequently chose not to file a formal application for a permit?

MC How many (and what proportion) of them returned with an altered plan?

Summary of Requested and Actual Wetland Fill

22. This category is based on the following questions:

How many acres of each wetland type (i.e., system, subsystem, and class; according to the Cowardin et al. (1979) wetland classification system):

MC • did applicants ask to fill during their first preapplication counseling session (if any) with a Corps representative?

LMC • did applicants ask to fill in their formal applications for Section 404 permits?

LMC • were applicants permitted to fill?

MC • did permittees actually fill during project construction?

LMC What proportion of projects involved wetland fill within various acreage categories?

Mitigation Types

23. The query for this topic would be:

LMC Which of the five approaches to mitigation defined by the Council on Environmental Quality were most often embodied in Section 404 individual permits?

Avoiding and/or Minimizing Wetland Impacts

24. Questions for this category are listed below.

LMC How many acres (by wetland type) of wetland fill were avoided when applications for permits were withdrawn or denied?

LMC What was the overall effect of the permit review process (from application through final action) on the magnitude of wetland impacts?

MC What methods were used most frequently to avoid or minimize indirect impacts (e.g., erosion, sedimentation) during project construction?

MC How many acres (by wetland type) of wetland fill were avoided when potential applicants who participated in preapplication counseling subsequently chose not to apply for a permit?

MC For those applicants who participated in preapplication counseling, what effect did the counseling have on the number of acres of wetland fill requested?

Impacts to Societal Features

25. Questions for this category are listed below.

C How many (and what proportion of) permitted projects involved impacts to societal features (e.g., piers, walkways, human-use areas, aesthetic values) that were not the focus of construction activities?

C In what proportion of projects were potential impacts to societal features avoided due to withdrawal or denial of permit applications?

C In what proportion of projects were potential impacts to societal features minimized due to changes in the magnitude of the project during the permit review process?

C What kinds of societal impacts were most frequently associated with Section 404 individual permits?

Potential Impacts to Wetland Functions and Values

26. Questions for this category are listed below.

MC For which wetland functions and values were concerns about potential impacts raised most often during the permit review process?

MC For which wetland functions and values were specific actions to mitigate impacts most often incorporated into permit conditions or project designs?

C What was the average rating or measure of each wetland function in impacted wetlands?

Wetland Restoration

27. Questions for this category are listed below.

LMC How many (and what proportion of) permits required wetland restoration as mitigation for damages?

LMC How many acres of each wetland type were permittees required to restore?

LMC What was the average elapsed time between the date of wetland damage and the completion date of restoration activities?

LMC What proportion (by wetland type) of these restorations initially were "in kind" (i.e., the wetland type restored initially was the same as that filled)?

MC What methods were used most often to restore wetlands damaged during project construction?

MC What acreages and wetland types did permittees actually restore?

MC Allowing for ecological succession, what wetland types were most often the long-term goals of restoration activities?

MC In what proportion of permits was the long-term goal "in kind" restoration of impacted wetlands?

C What plant species were permittees most often required to plant in restored wetlands?

Wetland Compensation

28. Questions for this category are listed below.

LMC How many (and what proportion of) permits required wetland creation as compensation for unavoidable impacts?

LMC How many acres of each wetland type were applicants required to construct from nonwetlands as a condition of their permits?

LMC How many acres of low-value or degraded wetlands were applicants required to enhance?

LMC What is the average distance between the site where wetland fill was authorized and the site where wetland creation/enhancement was done?

LMC At what proportion of projects was the compensation wetland completed before the original wetland was destroyed?

LMC What range of ages (i.e., time elapsed since construction) is represented by compensation wetlands?

LMC What proportion of wetland compensation projects were "in kind"?

LMC What proportion of the acreage of filled wetlands was compensated "in kind"?

LMC What wetland types were most often compensated "in kind"?

MC What methods were most often used to create or enhance wetlands as compensation for unavoidable losses?

MC How many acres of each wetland type did applicants actually construct?

MC Allowing for ecological succession, what wetland types were most often the long-term goals of compensation activities?

MC In what proportion of permits requiring compensation was the long-term goal "in kind" compensation for wetland impacts?

C What plant species and propagule types were most often used on compensation sites that were planted?

Compensation for Lost Functions and Values

29. Questions for this category are listed below.

MC What functions and values were most often considered and incorporated into the design of compensation wetlands?

MC Do compensation wetlands provide the same functions and values as those of the natural wetlands they replaced?

C Was the average quality of those functions or values equivalent to that of the wetlands that were destroyed?

Compensation for Impacts to Societal Features

30. Questions for this category are listed below.

C What percentage of projects that impacted societal features required compensation for those impacts?

C How did the kinds of societal features developed as compensation compare with those impacted by the projects?

Compliance Inspection and Postproject Monitoring

31. Questions for this category are listed below.

MC What proportion of projects exceeded, equaled, or undershot their permitted acreage of wetland fill?

MC In what proportion of projects requiring restoration or compensation did applicants succeed in establishing wetland vegetation within the time limit specified in the permit?

C What proportion of permits required the establishment of a monitoring program after completion of construction?

C What was the typical frequency and duration of monitoring?

C What wetland characteristics were most often monitored after project construction?

C What restoration/compensation methods were most successful in establishing wetland vegetation within permitted time limits?

Wetland Distribution and Cumulative Effects

32. Questions for this category are listed below.

LMC What was the spatial distribution of wetlands filled, restored, or created under Section 404 permits?

LMC What was the cumulative distribution of wetland acreage affected by Section 404 permitting activities in the District or Division?

PART IV: RECOMMENDED DATABASE CONTENTS

Selection of Variables

33. Table 2 is a list of potential variables to include in a mitigation database for the Section 404 permit program. (Tables 3-8 give suggested response codes for certain variables.) The list contains 69 variables, many of which require multiple answers for projects involving several different sites, wetland types, wetland functions and values, mitigation approaches, and restoration or compensation methods. To reduce complexity and to point out different options for implementation, each variable is designated by an L, M, or C denoting its appropriateness for a limited, moderate, or comprehensive database, respectively, as discussed in Part III.

34. The key identifying variable in each record is the file number, which is used to track an individual file through preapplication counseling (if any), formal application, final permit, and postproject compliance inspection. Appropriate dates and action codes may be added to the file number at each step. This modified file number is then used as the final permit number. Standard locational information (i.e., county, hydrologic unit, state) can be derived from the UTM coordinates of the project and do not need to be entered separately, if the District has been digitized and the UTM locations of various geographic subregions are known.

35. Potential project impacts, both within and beyond the limits of the fill, are noted at each step in the permitting process, allowing analysis of mitigation through avoidance or minimization of impacts. All wetland acreages are recorded by wetland type (i.e., system), as defined by the Cowardin et al. (1979) wetland classification. Additional variables denoting vegetation subclasses or water regimes may be added, if desired. Mitigation types follow those defined by the Council on Environmental Quality (40 CFR 1508.20), and mitigation concerns are recorded in terms of recognized wetland functions and values.

36. A total of 28 variables are listed for a limited database, not counting possible multiple responses to each item. Most of this information should be available from the standard permit record, as long as data are recorded in sufficient detail. Details that are needed, and which may have been lacking in older permits, include acreages of each wetland type impacted,

restored, enhanced, and created; mitigation approaches embodied in the permit; completion dates for restoration or compensation; and UTM coordinates of project sites. For a limited database, the process of data collection for each permit would begin when the formal application is received and would end when wetland restoration or compensation is completed.

37. An additional 19 (total = 47) variables (not counting multiple responses) are included in a moderate database. In addition to the data contained in the limited application, the moderate database includes information on specific wetland functions and values that were identified as concerns during permit review and project planning, mitigation goals, methods used in wetland restoration or compensation, and data gathered during postproject compliance inspections. Furthermore, a moderate database includes information on all preapplication counseling sessions (identified by file number), even if they were not followed by an application for a permit. Data gathering for a moderate database begins with any preapplication sessions and ends with one or more postproject inspections.

38. A comprehensive database would consist of all 69 variables in Table 2, including information on mitigation of societal impacts, measurements or ratings of the functions and values provided by project wetlands before they were impacted, details of plantings in restoration or compensation areas, general information on monitoring programs required in the permit, and ratings of functions and values provided by compensation wetlands.

Implementation

39. Implementation of the mitigation database will require additional record-keeping by project managers, but most of the information should be readily available. Much of it is routinely considered in the Statement of Findings and in permit terms and conditions. One important need is the consistent documenting of preapplication counseling meetings, particularly the extent of fill originally proposed by the applicant. It is also important to document all such meetings, even when they did not result in a formal application for a permit.

40. To ensure the accuracy and consistency of information entered into the database, new project managers may need training in wetland

classification, mitigation approaches, and wetland functions and values. The amount of time required to enter data into the database could be minimized by designing specialized screen displays for direct data entry at computer terminals or networked microcomputers, bypassing paper forms entirely.

41. The design and contents of the mitigation database should be flexible enough that it can evolve with the changing needs of the District. In the future, new variables may be needed as questions about mitigation practices become more refined and methods for answering them become more sophisticated. For example, rapid techniques for assessing wetland functions and values must be developed that will allow comparisons of the magnitude of important functions among impacted, restored, and created wetland sites, allowing investigators to evaluate how well the permitted project mitigated specific functional impacts. Current assessment methods (e.g., Adamus et al. 1987) may be difficult to use and interpret when applied to small permit sites, and often do not measure the magnitude of a desired function.

42. Another role for future versions of the database might be to document and assess long-term goals for restored or created wetlands, such as anticipated water quality or abundance of water-dependent birds, so that long-term success can be evaluated. The mitigation database recommended in this report is intended as a starting point in the evolution of more sophisticated regulatory tools.

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Table 1

Mitigation Topics Included in Each of Three Alternative Levels of Database Complexity

Topic	Level of Implementation		
	Limited	Moderate	Comprehensive
Effects of preapplication counseling		X	X
Effect of application withdrawal or denial	X	X	X
Location and proximity of impacted and created wetlands	X	X	X
Permitted acreage of fill and associated impacts	X	X	X
Wetland acreage restored, created, and enhanced	X	X	X
Impact reduction as a result of permit review	X	X	X
Mitigation of damages to societal features			X
Identification of mitigation approaches	X	X	X
Identification of wetland functions and values impacted and mitigated		X	X
Preproject and postproject assessments of wetland functions			X
Methods used to restore or create wetlands		X	X
Success of vegetation establishment		X	X
Species of vegetation planted			X
Actual wetland acreage damaged, restored, and created			X
Functional assessment of created wetlands			X
Characteristics of monitoring plans			X

Table 2

Detailed Description of Variables Suggested for a Section 404 Mitigation Database

Variable	Suggested Format*	Database Level**
General Information		
Preapplication file number	These key identifiers may be derived by combining a file number, dates, and action codes.	MC
Application number (if any)		LMC
Permit number (if any)		LMC
Dates		
• Final permit was issued	D	LMC
• Wetland impacts began	D†	LMC
• Wetland impacts were completed	D†	LMC
• Efforts to restore damaged wetlands were completed	D†	LMC
• Construction of compensation wetlands was completed	D†	LMC
Project name or nearest town	C12††	LMC
County	C12‡ (or derived from UTM coordinates)	LMC
Hydrologic unit, watershed, or river basin	C12‡ (or derived from UTM coordinates)	LMC

(Continued)

* D = date, C = character data (number is field width), N = numeric data (x.y denotes field width [x] and number of decimal places [y]).

** See Part III of text.

† If the project involved more than one wetland site, record this information separately for each site.

†† For some character data, the use of standard codes could reduce the required field width.

‡ Allow for multiple responses.

Table 2 (Continued)

Variable	Suggested Format	Database Level
General Information (Cont.)		
State	C2* (or derived from UTM coordinates)	LMC
UTM coordinates of project center (to the nearest 100 m):		
• UTM grid zone (if there is more than one zone in the jurisdictional area)	C4**	LMC
• North coordinate	N5.0**	LMC
• East coordinate	N5.0**	LMC
Name of USGS 7.5-min topographic map (give name of 15-min map, if necessary)	C12 (or derived from UTM coordinates)	MC
Summary of Impacts		
At the start of preapplication counseling (if any), how many acres of each wetland type did the applicant initially wish to fill? (Wetland types should be specified to class level according to the Cowardin et al. (1979) classification system (see Table 3). If wetland type is unknown at this stage, record total acreage of wetland fill.)	C4 (wetland types) N6.2 (acreages)	MC
At the start of preapplication counseling, how many additional acres of each wetland type would have been impacted beyond the limits of the fill (e.g., due to altered hydrology)?	C4 (wetland types) N6.2 (acreages)	MC

(Continued)

* Allow for multiple responses.
** If the project involved widely scattered wetland impact sites, record UTM coordinates separately for each site.

Table 2 (Continued)

Variable	Suggested Format	Database Level
Summary of Impacts (Cont.)		
In the formal application for a permit, how many acres of each wetland type did the applicant propose to fill?	C4 (wetland types) N6.2 (acreages)	LMC
In the application, how many additional acres of each wetland type would have been impacted beyond the limits of the fill?	C4 (wetland types) N6.2 (acreages)	LMC
In the final permit, how many acres of each wetland type was the applicant permitted to fill?	C4 (wetland types) N6.2 (acreages)	LMC
In the final permit, how many additional acres of each wetland type would be impacted beyond the limits of the fill?	C4 (wetland types) N6.2 (acreages)	LMC
How many separate wetland sites or units were impacted?	N2.0	LMC
During preapplication counseling, what potential impacts to societal features (i.e., man-made features, public resources, or aesthetic values) were identified? (Do not count the focus of the project, such as destruction of the old bridge during bridge replacement.)	C4 (allow for multiple responses)	C
What impacts to societal features are implicit (if not actually stated) in the formal application for a permit?	C4 (allow for multiple responses)	C
What impacts to societal features were allowed in the final permit?	C4 (allow for multiple responses)	C

(Continued)

Table 2 (Continued)

Variable	Suggested Format	Database Level
Mitigation Approaches and Concerns		
Which of the approaches to mitigation described by the Council on Environmental Quality were embodied in permit conditions or project designs? (See Table 4 for a list of approaches. Include approaches that were incorporated into project plans before permit review.)	C1 (allow for multiple responses)	LMC
For which wetland functions and values were concerns about potential impacts raised during the permit review process? (See Table 5 for a list of wetland functions and values.)	C2 (allow for multiple responses)	MC
For which wetland functions and values were specific actions to mitigate impacts incorporated into permit conditions or project designs? (Include measures that were incorporated into project plans before permit review.)	C2 (allow for multiple responses)	MC
What precautions were taken during construction to avoid or minimize impacts to wetlands adjacent to those directly affected by the project (e.g., hay bales to trap sediment in runoff, temporary plantings or fabrics for erosion control)?	C2 (allow for multiple responses)	MC
What was the quality, rating, or score for each wetland function and value in the impacted wetland before the project was initiated? (Use a standardized and repeatable method, such as Adamus et al. (1987) or direct sampling.)	C2* (allow for multiple responses)	C

(Continued)

* If the project involves more than one wetland basin or unit, respond separately for each unit.

Table 2 (Continued)

Variable	Suggested Format	Database Level
Restoration of Resource Damages		
(Complete this section only if the project involved restoration as a mitigation approach.)		
How many acres of each wetland type was the permittee required to restore under the terms of his permit or as part of his project plans? (Do not include compensation wetlands.)	C4 (wetland types) N6.2 (acreages)	LMC
What methods were used to restore wetland areas? (See Table 6 for initial list of methods.)	C2 (allow for multiple responses)	MC
What wetland functions and values were intended as goals of the restoration?	C2 (allow for multiple responses)	MC
Allowing for ecological succession, how many acres of each wetland type were intended as long-term restoration goals?	C4 (wetland types) N6.2 (acreages)	MC
If the permittee was required to plant wetland vegetation in restored areas, what species, acreages, and propagule types were required in the permit?	C4* N6.2** (allow for multiple responses)	C
What was the date by which vegetation development in restored areas met the criteria for success specified in the permit?	D	C
Was it necessary to do additional work after project completion to satisfy the criteria for success of vegetation restoration specified in the permit?	C1	C
What societal features damaged by the project was the permittee required to restore?	C2 (allow for multiple responses)	C

(Continued)

* Develop standard codes for species (or mix of species) and propagule types.

** Record acreage separately for each species or mix of species.

Table 2 (Continued)

Variable	Suggested Format	Database Level
Compensation for Resource Loss (Complete this section only if the project involved compensation as a mitigation approach.)		
In the final permit or project plans, how many separate wetland basins or units were to be created or enhanced?	N2.0	LMC
What is the average distance (meters) between the site(s) of wetland destruction and the site(s) of wetland compensation?	N6.0 (or derived from UTM coordinates)	LMC
UTM coordinates of the center of the compensation area (to the nearest 100 m):		
• UTM grid zone (if there is more than one zone in the jurisdictional area)	C4*	LMC
• North coordinate	N5.0*	LMC
• East coordinate	N5.0*	LMC
How many acres of each wetland type was the permittee required to create under the terms of his permit or project plans? (Do not include wetland restoration.)	C4 (wetland types) N6.2 (acreages)	LMC
How many acres of each wetland type was the permittee required to enhance under the terms of his permit or project plans? (Do not include restoration of damage caused by this project.)	C4 (wetland types) N6.2 (acreages)	LMC
What methods were used in wetland compensation? (See Table 7 for an initial list of methods.)	C2 (allow for multiple responses)	MC

(Continued)

* If the project involved widely scattered wetland compensation sites, record UTM coordinates separately for each site.

Table 2 (Continued)

Variable	Suggested Format	Database Level
Compensation for Resource Loss (Cont.)		
Allowing for ecological succession, how many acres of each wetland type were intended as long-term compensation goals?	C4 (wetland types) N6.2 (acreages)	MC
If the permittee was required to plant wetland vegetation in compensation areas, what species, acreages, and propagule types were required in the permit?	C4* N6.2** (allow for multiple responses)	C
What wetland functions and values were deliberately incorporated into the design of the compensation wetland(s)? (In other words, what were the functional goals of the compensation?)	C2 (allow for multiple responses)	MC
What was the date by which vegetation development in compensation areas met the criteria for success specified in the permit?	D	C
Was it necessary to do additional work after project completion to satisfy the criteria for success of vegetation development specified in the permit?	C1	C
What societal features damaged by the project was the permittee required to compensate?	C2 (allow for multiple responses)	C
Compliance Inspection		
Date(s) of compliance inspections	D (allow for multiple responses)	MC
At the completion of the project, how many acres of each wetland type did the permittee actually fill?	C4 (wetland types) N6.2 (acreages)	MC

(Continued)

* Develop standard codes for species (or mix of species) and propagule types.

** Record acreage separately for each species or mix of species.

Table 2 (Continued)

Variable	Suggested Format	Database Level
Compliance Inspection (Cont.)		
At the completion of the project, how many additional acres of each wetland type were impacted beyond the limits of the fill?	C4 (wetland types) N6.2 (acreages)	MC
What impacts to societal features actually occurred during project construction?	C2 (allow for multiple responses)	C
How many acres of each wetland type did the permittee actually restore?	C4 (wetland types) N6.2 (acreages)	MC
What species, acreages, and propagule types were actually planted in restored wetlands?	C4* N6.2** (allow for multiple responses)	C
What was the quality, rating, or score for each wetland function or value in the restored wetland(s)?	C2† (allow for multiple responses)	C
What societal features damaged by the project did the permittee actually restore?	C2 (allow for multiple responses)	C
How many acres of each wetland type did the permittee actually create?	C4 (wetland types) N6.2 (acreages)	MC
How many acres of each wetland type did the permittee actually enhance?	C4 (wetland types) N6.2 (acreages)	MC

(Continued)

* Develop standard codes for species (or mix of species) and propagule types.

** Record acreage separately for each species or mix of species.

† If the project involves more than one wetland basin or unit, respond separately for each unit.

Table 2 (Concluded)

Variable	Suggested Format	Database Level
Compliance Inspection (Cont.)		
What species, acreages, and propagule types were actually planted in created/enhanced wetlands?	C4* N6.2** (allow for multiple responses)	C
What was the quality, rating, or score for each wetland function or value in the compensation wetland(s)?	C2 (allow for multiple responses)	C
What societal features damaged by the project did the permittee actually compensate?	C2 (allow for multiple responses)	C
Postproject Monitoring (Monitoring involves periodic sampling of vegetation, fauna, water, or other components of the wetland system. A monitoring program may be independent of any compliance inspections.)		
What components of the system were subject to monitoring (see Table 8 for initial list of components)?	C2 (allow for multiple responses)	C
What was the required frequency of monitoring for each wetland component?	C2 (allow for multiple responses)	C
What was the required duration of monitoring for each wetland component?	C2 (allow for multiple responses)	C

* Develop standard codes for species (or mix of species) and propagule types.

** Record acreage separately for each species or mix of species.

Table 3

Wetland Classification System* Recommended for Use with the Mitigation Database

System	Subsystem	Class**	Code†
Marine	Subtidal	Rock bottom	M1RB
		Unconsolidated bottom	M1UB
		Aquatic bed	M1AB
		Reef	M1RF
	Intertidal	Aquatic bed	M2AB
		Reef	M2RF
		Rocky shore	M2RS
		Unconsolidated shore	M2US
Estuarine	Subtidal	Rock bottom	E1RB
		Unconsolidated bottom	E1UB
		Aquatic bed	E1AB
		Reef	E1RF
	Intertidal	Aquatic bed	E2AB
		Reef	E2RF
		Streambed	E2SB
		Rocky shore	E2RS
		Unconsolidated shore	E2US
		Emergent wetland	E2EM
		Scrub-shrub wetland	E2SS
		Forested wetland	E2FO
Riverine	Tidal	Rock bottom	R1RB
		Unconsolidated bottom	R1UB
		Aquatic bed	R1AB
		Rocky shore	R1RS
		Unconsolidated shore	R1US
		Emergent wetland	R1EM
	Lower perennial	Rock bottom	R2RB
		Unconsolidated bottom	R2UB
		Aquatic bed	R2AB
		Rocky shore	R2RS
		Unconsolidated shore	R2US
		Emergent wetland	R2EM

(Continued)

* Cowardin et al. (1979).

** Specify wetland type to class level (e.g., estuarine intertidal emergent wetland, palustrine forested wetland).

† Similar to those used by the Fish and Wildlife Service on National Wetland Inventory maps.

Table 3 (Concluded)

System	Subsystem	Class	Code
Riverine (Cont.)	Upper perennial	Rock bottom	R3RB
		Unconsolidated bottom	R3UB
		Aquatic bed	R3AB
		Rocky shore	R3RS
		Unconsolidated shore	R3US
	Intermittent	Streambed	R4SB
Lacustrine	Limnetic	Rock bottom	L1RB
		Unconsolidated bottom	L1UB
		Aquatic bed	L1AB
	Littoral	Rock bottom	L2RB
		Unconsolidated bottom	L2UB
		Aquatic bed	L2AB
		Rocky shore	L2RS
		Unconsolidated shore	L2US
		Emergent wetland	L2EM
Palustrine		Rock bottom	PRB
		Unconsolidated bottom	PUB
		Aquatic bed	PAB
		Unconsolidated shore	PUS
		Moss-lichen wetland	PML
		Emergent wetland	PEM
		Scrub-shrub wetland	PSS
		Forested wetland	PFO

Table 4

Approaches to Mitigation*

Code	Approach
0	No mitigation.
1	Avoiding an impact altogether by not taking a certain action or parts of an action (e.g., withdrawing the permit application; using an upland source of fill material rather than a wetland source).
2	Minimizing impacts by limiting the degree or magnitude of the action and its implementation (e.g., reducing the scope of the project or the number of acres impacted).
3	Rectifying the impact by repairing, rehabilitating, or restoring the affected area (e.g., removing a temporary cofferdam, regrading and replanting a pipeline corridor).
4	Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the project (e.g., requiring that fish be stocked annually as mitigation for impacts to spawning beds).
5	Compensating for the impact by replacing or providing substitute resources or environments (e.g., enhancing a nearby degraded wetland or constructing a new wetland in former upland).

* Adapted from 40 CFR 1508.20.

Table 5

Wetland Functions and Values*

Code	Function or Value
GR	Ground-water recharge
GD	Ground-water discharge
FS	Flood storage and desynchronization
SS	Sediment and shoreline stabilization
SR	Sediment/toxicant retention
NT	Nutrient retention/transformation
NE	Nutrient export
AD	Aquatic diversity/abundance
FH	Fish or shellfish habitat
WH	Wildlife habitat
ES	Endangered species
CR	Consumptive recreation (e.g., hunting, fishing)
NR	Nonconsumptive recreation (e.g., boating, aesthetics)
UH	Uniqueness/heritage

* Adapted from Sather and Smith (1984) and Adamus et al. (1987).

Table 6

Methods Used in Wetland Restoration

Code	Method
01	Removing temporary fill material
02	Removing mats or other artificial surfaces
03	Replacing soil removed during construction
04	Regrading disturbed areas
05	Removing temporary water-control structures
06	Building permanent water-control structures
07	Providing alternate source(s) of water to the area
08	Replanting vegetation that was removed and preserved during construction
09	Planting or seeding wetland species obtained from another source
10	Applying soil amendments (e.g., fertilizer)
11	Providing protection from animal depredation
12	Providing protection from human disturbance
13	Providing protection from erosion or accretion within the restored wetland
	Other (develop additional codes)

Table 7

Methods Used in Wetland Compensation

Code	Method
01	Restoring historical wetlands (now upland) by removing old fill material
02	Restoring historical wetland hydrology and/or tidal influence
03	Enhancing an existing wetland by altering substrate elevations
04	Enhancing an existing wetland by altering hydrology independent of substrate elevation
05	Enhancing an existing wetland through management of existing vegetation
06	Creating a new wetland by filling deepwater areas
07	Creating a new wetland by draining deepwater areas
08	Creating a new wetland by excavating upland
09	Creating a new wetland by providing water to former upland
10	Building permanent water-control structures
11	Transferring soil or organic matter (perhaps containing propagules) from the impacted wetland
12	Transplanting vegetation from the impacted wetland
13	Planting or seeding appropriate species from another source
14	Applying soil amendments (e.g., fertilizer)
15	Providing protection from animal depredation
16	Providing protection from human disturbance
17	Providing protection from erosion or accretion
	Other (develop additional codes)

Table 8

Components of Wetland Systems for Monitoring

Code	Component
01	Waterfowl breeding
02	Waterfowl migrating
03	Waterfowl wintering
04	Other water-dependent birds breeding
05	Other water-dependent birds migrating
06	Other water-dependent birds wintering
07	Songbirds breeding
08	Songbirds migrating
09	Songbirds wintering
10	Aquatic mammals and furbearers
11	Other mammals
12	Reptiles and amphibians
13	Invertebrates
14	Vegetation coverage, structure, or species composition
15	Below-ground plant biomass
16	Sedimentation or organic-matter accumulation
17	Water quality, clarity, or nutrient content
18	Contaminants
	Other (develop additional codes)

APPENDIX A: HYPOTHETICAL EXAMPLES OF OUTPUT FROM A MITIGATION DATABASE

Table A1

Hypothetical Frequency Distribution of Projects by Permitted Acreage of Wetland Fill

Size of Project, acres	Number of Projects
>0.0 to 1.0	1,427
>1.0 to 5.0	533
>5.0 to 10.0	245
>10.0 to 15.0	160
>15.0 to 20.0	84
>20.0 to 25.0	42
>25.0 to 30.0	15
>30.0 to 35.0	8
>35.0 to 40.0	3
>40.0	13

Table A2

Hypothetical Acreage of Permitted Wetland Fill by Wetland Type

Class	Palus-trine	Lacus-trine	River-ine	Estu-arine	Marine	Total
Rock bottom	0.0	1.5	26.8	18.0	10.4	56.7
Unconsolidated bottom	4.7	22.8	19.4	11.3	2.8	61.0
Aquatic bed	8.5	2.4	0.9	0.0	0.0	11.8
Reef	--	--	--	0.0	0.0	0.0
Streambed	--	--	0.0	0.0	-	0.0
Rocky shore	--	3.9	8.8	2.4	9.5	24.6
Unconsolidated shore	16.8	33.5	4.9	12.6	32.8	100.6
Moss-lichen	0.0	--	--	--	--	0.0
Emergent wetland	79.8	28.9	15.5	12.6	--	136.8
Scrub-shrub	87.6	--	--	19.0	--	106.6
Forested wetland	129.4	--	--	42.7	--	172.1
Total	326.8	93.0	76.3	118.6	55.5	670.2

Table A3

Hypothetical Summary of Methods Used in Wetland Restoration Projects

Method	Number of Permits	Number of Acres
Removing temporary fill material	84	59.60
Removing mats or other artificial surfaces	22	38.75
Replacing soil removed during construction	44	52.59
Regrading disturbed areas	159	102.63
Removing temporary water-control structures	62	48.00
Building permanent water-control structures	13	68.25
Providing alternate source(s) of water to the area	5	12.20
Replanting vegetation that was removed and preserved during construction	17	24.12
Planting or seeding wetland species obtained from another source	96	116.55
Applying soil amendments (e.g., fertilizer)	29	34.05
Providing protection from animal depredation	12	16.88
Providing protection from human disturbance	32	58.20
Providing protection from erosion or accretion	125	156.30
Total number of projects involving wetland restoration	214	
Total number of acres of restored wetlands		327.80

Table A4

Hypothetical Net Gain (+) or Loss (-) in Wetland Acreage Resulting from Wetland Filling, Restoration, and Compensation

Class	Palus-trine	Lacus-trine	River-ine	Estu-arine	Marine	Net Change
Rock bottom	-7.5	-8.0	-5.5	-16.6	-4.1	-41.7
Unconsolidated bottom	-17.0	29.0	-2.5	-26.2	-9.4	-26.1
Aquatic bed	12.4	8.6	-0.9	0.0	0.0	20.1
Reef	--	--	--	0.0	0.0	0.0
Streambed	--	--	0.0	0.0	--	0.0
Rocky shore	--	-3.9	-10.2	-8.0	-23.9	-46.0
Unconsolidated shore	-19.6	23.4	12.2	-23.6	-2.7	-10.3
Moss-lichen	0.0	--	--	--	--	0.0
Emergent wetland	75.2	52.0	26.8	32.2	--	186.2
Scrub-shrub	-33.0	--	--	-24.4	--	-57.4
Forested wetland	-102.8	--	--	-56.3	--	-159.1
Net change	-92.3	101.1	19.9	-122.9	-40.1	-134.3

Table A5

Hypothetical Change in Potential Acreage of Wetland Impacts at Each Step in the Permitting Process

Wetland Type	Preapplication Request (1)	Formal Application (2)	Final Permit (3)	Postproject Inspection (4)	Percent Change (1) - (4)
Palustrine	369.2	240.8	187.9	204.2	-44.7
Lacustrine	121.5	105.4	92.9	90.2	-25.8
Riverine	222.2	188.3	158.4	168.8	-24.0
Estuarine	186.0	174.3	165.8	160.5	-13.7
Marine	28.8	25.8	22.9	23.5	-18.4
Total	927.7	734.6	627.9	647.2	-30.2

Table A6

Hypothetical Comparison of WET* Effectiveness Ratings Between Filled Wetlands and Constructed Wetlands for Projects Requiring Compensation

Wetland Functions and Values	Filled Wetlands			Compensation Wetlands			Number Increasing	Number Declining
	High	Moderate	Low	High	Moderate	Low		
Ground-water recharge	14	52	27	18	49	26	5	0
Ground-water discharge	28	58	7	19	64	10	3	9
Floodflow alteration	9	72	12	16	75	2	23	6
Sediment stabilization	12	49	32	9	58	26	8	5
Sediment/toxicant retention	5	37	51	3	33	57	0	8
Production export	19	61	13	19	65	9	6	2
Wildlife diversity/ abundance								
• Breeding	5	73	15	17	69	7	24	4
• Migration	28	41	24	29	44	20	12	7
• Wintering	18	53	22	24	62	7	32	11
Aquatic diversity abundance	11	62	20	23	64	6	27	1

* Wetland Evaluation Technique (Adamus et al. 1987).